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(54) System to calculate buisiness performance index

(57) A computer is used to perform the calculations of obtaining: a required capital composition (an optimum debt/equity ratio) of an invested capital with a corresponding default probability based on a probability distribution of a return on investment; a weighted average cost of capital based on the capital composition, a borrowing cost, and an equity cost; a market efficiency value added from the weighted average cost of capital based on a net operating profit after tax; a socio-environmental value added that represents, in value terms, a social contribution of an enterprise not directly listed in financial statements; and a future inspiration value by adding the socio-environmental value added to the market efficiency value added. This allows business performance to be evaluated appropriately and adequately.

FIG. 1

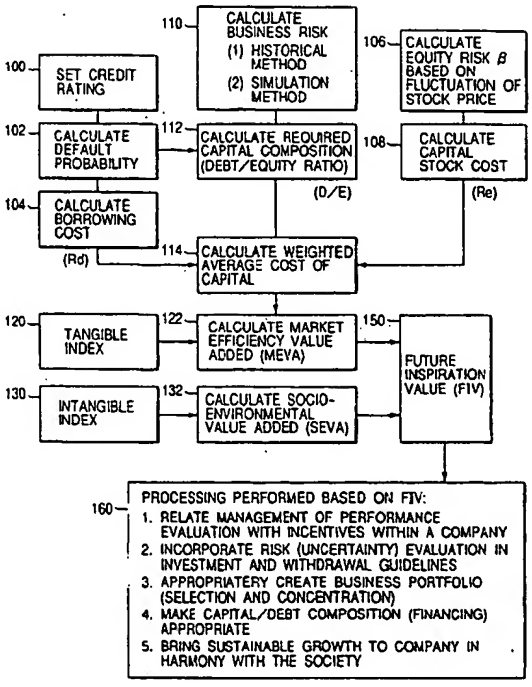

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Fig. 9 is a schematic diagram showing a relationship between exogenous variables and profit according to the simulation method;
Fig. 10 is a graph showing the probability distribution of a profit absolute value;
Fig. 11 is a graph showing a profit before tax and a cumulative profit of an investment plan;
Fig. 12 is a graph showing MEVA and a cumulative MEVA of an investment plan;
Fig. 13 is a system configuration diagram showing a business performance index processing system according to an embodiment of the present invention;
Fig. 14 is a processing operation flowchart in a business performance index processing system;
Fig. 15 is another processing operation flowchart in a business performance index processing system;
Fig. 16 is a processing operation flowchart for MEVA in a business performance index processing system;
Fig. 17 is a processing operation flowchart for SEVA and FIV in a business performance index processing system.
Fig. 18 is a processing operation flowchart of a historical method in the step 110; and
Fig. 19 is a processing operation flowchart of a simulation method in the step 110.

Description of the Preferred Embodiments

[0015] The business performance index processing system according to the present invention may be applicable to a business performance index used to measure performance of an entire enterprise or business units in the enterprise, or evaluate a new business to be started.

[0016] The business performance index processing system according to the present invention first obtains the required capital composition (the optimum debt/equity ratio) of the invested capital based on the probability distribution of return on invested capital, and obtains the cost of capital thereof. It then subtracts the cost of capital from an operating profit to obtain the market efficiency value added (MEVA) as the economical business performance index.

[0017] The system then estimates intangible value which is not listed in financial statements and not directly incorporated in price or cost, thereby obtaining the socio-environmental value added (SEVA) as the business performance index in terms of external economies.

[0018] The system then combines these two indices together to obtain the future inspiration value (FIV) that is the business performance index representing the generic value of an enterprise.

[0019] Fig. 1 is a flowchart showing a concept of a business performance index processing system according to the present invention;

[0020] The embodiment according to the present invention may comprise the following steps of evaluating the enterprise using the tangible index and intangible index. They are the steps of evaluating the market efficiency value added (MEVA) (step 122), the socio-environmental value added (SEVA) (step 132), and the future inspiration value (FIV) (step 150). It thereby provides business performance indices that relate the management of performance evaluation within a company, incorporate a risk (uncertainty) evaluation in the investment and withdrawal guidelines, appropriately create a business portfolio (selection and concentration), make the capital composition (financing) appropriate, and eventually bring a sustainable growth to the company in harmony with the society.

[0021] The calculation performed to evaluate the market efficiency value added (MEVA) will be described.

[0022] The economic value added of a business is calculated by subtracting the cost of capital invented in the business from the profit earned by the business. Namely, it is expressed as:

$$\text{Market Efficiency Value Added} = \text{Net Operating Profit after Tax} - \text{Cost of Capital} \quad (1)$$

The net operating profit after tax is a net profit before interest after tax as obtained from financial statements.
The cost of capital is an expense incurred in invested capital (that is, an amount of invested money required for expanding the business). The invested capital is calculated as:

$$\text{Invested Capital} = \text{Debt} + \text{Equity} \quad (2)$$

The invested capital is therefore the sum of a fund (debt) raised as the money borrowed from financial institutions such as banks to set up and carry out the business and through issuing bonds, and a fund (equity) raised as the capital stock obtained as a result of issuing stocks or the like and retained earnings or the like. The ratio of the cost of capital to the invested capital is the weighted average cost of capital. Namely, it is expressed as:

"0.1%" and a borrowing cost of "1.7%". A table of credit ratings relating to corresponding default probability and borrowing cost values as shown in Fig. 3 is created from a database that stores therein past default records and borrowing costs of different enterprises associated with each of these credit ratings.

[0030] When a target credit rating of the enterprise is set in step 100 using a correspondence table such as this one, the default probability is determined in step 102, and the borrowing cost is determined in step 104.

[0031] An exact relationship exists among the credit rating, default probability, and borrowing cost. There is no specific order of setting these parameters, although credit rating is set first in the above example. Entering any one of the credit rating, default probability, and borrowing cost will allow the remaining two parameters to be set.

[0032] The equity cost (Re) will be described.

[0033] It represents the cost for the equity (dividends to be paid to stockholders or an increase in retained earnings), having a relationship with an equity risk β.

[0034] Reference is now made to Fig. 4, in which the horizontal axis represents the return for the market index (Rm) (for example, the Tokyo Stock Price Index abbreviated as TOPIX), while the vertical axis represents the return of the target enterprise (Ri) (or the per share earning ratio of a company in the same industry, if the target enterprise is not listed). For this graph, actual values are plotted at intervals of daily, weekly, or monthly for a few tens of unit periods to obtain the equity risk β which is the gradient of the regression line. Namely, using a regression equation (7) and based on the past data of the per share earning ratio (Ri) of the target enterprise (or the per share earning ratio of a company in the same trade, if the target enterprise is not listed) and the per share earning ratio (Rm) for the market index, the equity risk β can be obtained through calculation using the equation (8):

$$Ri = \alpha + \beta \times Rm + \varepsilon i \quad (7)$$

$$\beta = (\text{covariance between Ri and Rm}) / (\text{variance of Rm}) \quad (8)$$

[0035] The equity risk β indicates the magnitude of volatility of the stock price in question, that is, how many times as much as the volatility of the market average. The greater the risk, the much return is required, thus increasing the equity cost.

[0036] According to a capital asset pricing model (CAPM), if the equity risk values are indicated on the horizontal axis and the per share earning ratio (R) is indicated on the vertical axis as shown in Fig. 5, a risk-return line is given as a straight line.

[0037] Suppose that a risk-free rate, which is rate of return on risk-free assets such as sovereign bonds whose equity risk value is 0, is Rf and the per share earning ratio for the market index (TOPIX) whose equity risk value is 1 is Rm. Then, the return value (R) at the intersection point between the equity risk β and the risk-return straight line would be the equity cost (Re). Namely, the following equation is given.

$$Re = Rf + \beta \times (Rm - Rf) \quad (9)$$

[0038] Using these techniques, the value of the equity risk β is calculated in step 106 and the capital stock cost (Re) is calculated In step 108.

[0039] The required capital composition (the optimum debt/equity ratio) of the invested capital will be described.

[0040] Even if an enterprise makes loss as a result of volatility of earnings by a business risk, it can continue business as long as the loss remains in the equity portion. If, however, the loss exceeds the equity portion, insolvency results causing the enterprise to go bankrupt. That is, there is a relationship among the earnings probability distribution, capital composition, and default probability.

[0041] According to the invention, the capital composition is obtained from the earnings probability distribution and default probability.

[0042] The required capital composition (the optimum debt/equity ratio) of the invested capital can be obtained from the earnings probability distribution.

[0043] A graph as shown in Fig. 2, in which the horizontal axis indicates the ratio of the value of profit to the invested capital (the invested amount of money) (ROI, or Return on Investment) (%) and the vertical axis indicates the probability frequency, shows a stochastic distribution curve of ROI with respect to the business risk.

[0044] Assuming that the entire area defined by the ROI stochastic distribution curve is 100% and the default prob-

called the socio-environmental value added (SEVA).

[0052] The sources of the socio-environmental value added (SEVA) are intangible assets. For example, items associated with the environment, such as the environmental management, environmentally-conscious manufacturing, environmentally-conscious production activities, and social interchange are translated in value terms for those quantitative items of the disclosed information of "environment accounting". They are the amount of CO_2 and other greenhouse gas emissions, industrial waste, energy saving, and recycling that are contained in the "Environmental Performance Indicators for Businesses (Fiscal Year 2000 Version)" compiled by the Ministry of the Environment (in Japan). In addition, the intangible assets in stock that may include brand value and social contribution through royalty free patent, freeware, and the like are also converted in value terms with the number of years through which the effects continue taken into consideration.

[0053] The calculation (step 150) for evaluating the future inspiration value (FIV) will be described.

[0054] The future inspiration value (FIV), which is the generic index that enhances an enterprise value, is calculated by multiplying the socio-environmental value added (SEVA) obtained in step 132 by a contribution factor (ε) that represents a ratio at which the SEVA contributes to the value added of the entire business and adding to it the market efficiency value added (MEVA) obtained in step 122. The management sets the contribution factor (ε) based on the review of two factors: one is a regression analysis of past data in terms of the relationship between the socio-environmental value added and the market efficiency value added and shareholder value; and the other is the degree of current and future interest in the socio-environmental value added as investigated through questionnaire or the like. Namely, the following equation is given.

$$\text{Future Inspiration Value} = \text{MEVA} + \varepsilon \times \text{SEVA} \tag{12}$$

[0055] When the future inspiration value (FIV) is obtained through the steps as described in the foregoing, it helps make an even more accurate decision of a choice of investment or withdrawal, based on the additional decisions provided by the cumulative MEVA and real option.

[0056] The calculation of a business risk (step 110) will be described. The probability distribution of ROI (profit/invested capital) of the business in question is obtained through a historical method, a simulation method, an RVM method, and the like.

[0057] The calculation of the probability distribution of ROI (return on invested capital) using the historical method will be first described. The historical method combines the following three distribution patterns to obtain the probability distribution of a future ROI (return on invested capital).

[0058] The first of the three distribution patterns is the past ROI distribution (a profit risk) as shown in Fig. 6. The example uses 50 readings of data of every half-term period during the past 25 years to show a frequency distribution in a bar graph. Based on this frequency distribution, a curve of a probability density function (for example, a normal distribution) approximating the distribution is obtained.

[0059] The second of the three distribution patterns is the distribution for deviations between expected and actual ROIs (an estimated risk) as shown in Fig. 7. It shows the distribution of deviations between the expected and the actual ROIs in the form of a bar graph. The graph shows a distribution of frequencies of the case of the estimate achieved placed on the right-hand side (+ side) of the graph and that of the estimate not achieved placed on the left-hand side (- side) with a zero point of the vertical axis as the boundary. Based on this frequency distribution, a curve of the probability density function (for example, normal distribution) that approximates the distribution is obtained. The distribution for deviations between expected and actual ROIs as that shown in Fig. 7 represents an error in achieving the plan.

[0060] As the third distribution pattern, the planned ROI for the business in question is input.

[0061] Based on these three inputs, the profit risk and the estimated risk are combined with the planned value at the center, thereby obtaining a probability distribution of the future ROI. For example, by combining the ROI distribution based on the past records (the profit risk) shown in Fig. 6, the distribution for deviations between expected and actual ROIs (the estimated risk) shown in Fig. 7, and the future ROI plan (for example, 8%), the ROI distribution as shown in Fig. 8 is obtained.

[0062] The calculation of probability distribution of ROI (return on invested capital) using the simulation method will next be described. The simulation method uses a computer model of a business plan for the business in question. Using the following equation,

$$\text{Profit} = f(\text{Exogenous Variables of Management}) \tag{13}$$

(For example, Profit = Market Size x Market Share x Selling Price - Manufacturing Cost)

culate the equity risk β from volatility of the stock prices (step 106), volatility of past Tokyo stock prices and that of the stock prices to be evaluated are obtained from an external database through the transmitter/receiver unit 178 (312). While this data is stored in the data file 182, the processing unit 174 creates the distribution graph shown in Fig. 4 to display it on the output unit 172 the graph together with the β value plotted on the graph (314). The β value plotted on the graph is validated by operating a return key on the display screen. This value is stored in the temporary storage unit 176. For the calculation of the capital stock cost (step 108), the processing unit 174 calculates the capital stock cost (Re) (320) after Rf has been input (318).

[0074] For the calculation of the business risk, the processing unit 174 calculates the ROI probability distribution shown in Fig. 2 using the historical method shown in Fig. 18 or the simulation method shown in Fig. 19, and creates the graph of Fig. 2 (110).

[0075] For the calculation of the required capital composition (112), when a setting value for the default probability of the enterprise to be evaluated is entered through the input unit 170 (322), the processing unit 174 calculates the required capital composition based on the result of calculation of the business risk (110) and the default probability (102). The processing unit 174 then calculates the weighted average cost of capital according to equation (5) (114). The unit 174 further calculates MEVA using data of profit after tax acquired from the data file 188 or an accounting index such as the peak value shown in Fig. 2 entered (120). This calculation is performed in accordance with equations (6), (10), and (11) (122). The processing unit 174 creates the graph shown in Fig. 11 or 12 to show the result of the calculations performed and makes the display device of the output unit 172 display it. The results of the calculations performed by the processing unit 174 are temporarily stored in the temporary storage unit 176 at different stages in the middle of calculation processes before the output is provided for the display. Those who are involved with a business performance evaluation make an investment decision by studying the graph that is displayed. It goes without saying that the processing unit 174 may be assigned for making a decision based on the value shown in the graph of Fig. 11 or 12. For example, an arrangement is possible, in which a criterion value for business performance evaluation may be set in advance and stored in the storage unit 176. The processing unit 174 then compares a current value on the graph against the setting value to see if the former is greater or smaller than the latter, thereby providing an output to serve as an investment decision.

[0076] Processing for SEVA and FIV will be described with reference to Fig. 17.

[0077] Processing is performed to determine investment items of the socio-environmental value added as a non-financial index (130). Typical investment items bracketed into this category are, for example, reduction in the amount of greenhouse gas emissions, reduction in industrial-waste, energy saving, recycling, enhancing a brand value, acquiring a patent, and the like. Each of these investment items is generally translated into a corresponding numerical value and input through the input unit 170. Some of these investment items go through arithmetic operations performed by the processing unit 174 before use after they have been input.

[0078] For the calculation of SEVA (132), a model is set for a profit to be yielded in the future or a value of reduced cost arising from the above investment items (344). A typical model is, for example, calculation of profit/reduced value = coefficient x invested value (320). The coefficient for each item is set based on past data or governmental and other disclosed data (346). When the corresponding coefficient is calculated and set for each investment item, the processing unit 174 calculates profit/reduced value of the item based on the corresponding coefficient (348). The processing unit 174 then performs arithmetic operations to find a current profit from the calculated future profit or the reduced cost value (350). This allows SEVA to be calculated.

[0079] Calculation of the future inspiration value (FIV) is next calculated (150). The processing unit 174 performs an arithmetic operation according to the equation (12) (352) and the result thereof is displayed or printed on the output unit 172 (354).

[0080] Those who make a business performance evaluation refer to the FIV, as the result of this output, and make a decision to invest or withdraw. It is nonetheless possible to let the processing unit 174 make the investment or withdrawal decision. For example, a criterion value for business performance evaluation may be set in advance and stored in the storage unit 176. The processing unit 174 then compares the FIV, or the calculation result, with the setting value to see if the former is greater or smaller than the latter.

[0081] As described in the foregoing, the business performance index processing system according to the present invention can accomplish the following task. Namely, it provides business performance indices that relate the management of performance evaluation with incentives within a company, incorporate a risk (uncertainty) evaluation in the investment and withdrawal guidelines, appropriately create a business portfolio (selection and concentration), make the capital composition (financing) appropriate, and eventually bring a sustainable growth to the company in harmony with the society.

[0082] Furthermore, according to the calculation system of the present invention, it is possible to vitalize operations within a company, determine investment or withdrawal for each business to concentrate on specific areas of businesses, ensure optimum corporate finance, and thereby allow the company to maintain the sustainable growth in harmony with the society.

obtaining a market efficiency value added from the weighted average cost of capital and a net operating profit after tax calculated through accounting processing;
obtaining socio-environmental value added (SEVA) by evaluating contribution to society and environment in monetary base; and
obtaining future inspiration value (FIV) from the market efficiency value added and the socio-environmental value added.

9. A business performance index processing system including:

a calculation process for a borrowing cost, in which the borrowing cost is calculated based on a default probability that is obtained through setting a target credit rating;
a calculation process for a capital stock cost, in which the capital stock cost is calculated from the rate of return that meets with an equity risk and the rate of return on the overall stock market;
a calculation process for a required capital composition, in which the required capital composition (the optimum debt/equity ratio) is calculated based on the default probability used in the calculation process of the borrowing cost, the default probability being based on a probability distribution of a return on investment;
a calculation process for a weighted average cost of capital, in which the weighted average cost of capital is calculated through obtaining a weighted average using the required capital composition (an optimum debt/equity ratio) calculated in the calculation process for the required capital composition (an optimum debt/equity ratio), the borrowing cost calculated in the calculation process for the borrowing cost, and the capital stock cost calculated in the calculation process for the capital stock cost;
a calculation process for a market efficiency value added, in which the market efficiency value added is calculated from the weighted average cost of capital and net operating profit after tax calculated through accounting processing;
a calculation process for a socio-environmental value added, in which the socio-environmental value added is calculated by evaluating a business that is not directly reflected in price or cost in terms of contribution to society and environment in monetary base; and
a calculation process for a future inspiration value, in which a value inherent in a business is calculated by adding the market efficiency value added calculated in the calculation process for the market efficiency value added and the socio-environmental value added calculated in the calculation process for the socio-environmental value added, multiplied by a contribution factor assigned to the value added of the entire business.

10. A business performance index processing system comprising:

a first means that calculates and sets a target credit rating;
a second means that calculates a default probability based on the target credit rating calculated and set by the first means;
a third means that calculates a borrowing cost based on the default probability calculated by the second means;
a fourth means that calculates an equity risk based on volatility of a stock price;
a fifth means that calculates a capital stock cost based on the equity risk calculated by the fourth means;
a sixth means that calculates a probability distribution based on a frequency of occurrence of each of different ROI values;
a seventh means that calculates a required capital composition (an optimum debt/equity ratio) from the probability distribution calculated and obtained by the sixth means and the default probability calculated by the second means;
an eighth means that calculates a weighted average cost of capital by taking a weighted average of the borrowing cost calculated and obtained by the third means and the capital stock cost calculated and obtained by the fifth means based on the required capital composition(an optimum debt/equity ratio) calculated and obtained by the seventh means;
a ninth means that calculates market efficiency value added from the weighted average cost of capital calculated and obtained by the eighth means and a net operating profit after tax calculated through accounting processing;
a tenth means that calculates socio-environmental value added by evaluating a business that is not directly reflected in price or cost in terms of contribution to society and environment in monetary base; and
an eleventh means that calculates a future inspiration value by adding the socio-environmental value added calculated and obtained by the tenth means, multiplied by a contribution factor assigned to a value added of an entire business, to the market efficiency value added calculated by the ninth means.

calculating an estimation error;
classifying the database in terms of key factors;
calculating a probability distribution of operating profits based on the database upon entering a planned value for the operating profit; and
obtaining a required capital composition (an optimum debt/equity ratio) from a ROI distribution, calculating a weighted average cost of capital, subtracting a cost of capital, and evaluating a business value of the specific operating department within the company with reference to a predetermined criterion to make a business investment decision.

17. In a business performance index processing system, a method of calculating a weighted average cost of capital through taking a weighted average by performing processing for dividing an invested capital required by a new business into a virtually required debt and capital using a probability distribution of a return on invested capital and a default probability in association with a credit rating that serves as a basis for a capital stock cost and a borrowing cost of an enterprise to be invested, and by weighting the capital stock cost and the borrowing cost using a ratio between the required debt and capital.

18. A business performance index processing system causing a computer to perform the calculations for:

obtaining a market efficiency added value;
obtaining a net present value (NPV) by discounting the market efficiency added value at weighted average cost of capital; and
obtaining a cumulative NPV by adding up the NPVs.

19. A system for processing business performance index using a computer, comprising:

a file that stores therein information relating to credit rating and default probability;
a file that stores therein information relating to stock prices;
a file that stores therein information relating to a ratio of a value of profit to an invested capital (ROI);
a file that stores therein information relating to a profit after tax;
an input unit, with which information to be stored in any of these files is input or a command for inputting of the information is issued;
a processing unit that performs the calculations, in relation to the information stored in these files, for obtaining a required capital composition (an optimum debt/equity ratio) of an invested capital based on a probability distribution of a return on investment, obtaining a weighted average cost of capital based on the capital composition, a borrowing cost, and obtaining a capital stock cost, and a market efficiency value added from the weighted average cost of capital and a net operating profit after tax; and
an output unit that is to produce an output of a result of processing performed by the processing unit, the unit being provided with at least a display unit.

20. The system for processing business performance index using a computer according to claim 19, further comprising:

a file that stores therein information relating to socio-environmental value added, wherein the processing unit is further provided with functions of performing calculations for obtaining the socio-environmental value added by evaluating contribution of a business to society and environment in monetary base and obtaining future inspiration value from the market efficiency value added and the socio-environmental value added.

21. The system for processing business performance index using a computer according to claim 19, wherein, with a return on investment (ROI) given on an axis, the output unit displays by means of a distribution diagram a probability distribution of each of ROI values or a probability density function of a normal distribution or the like approximating the probability distribution.

22. The system for processing business performance index using a computer according to claim 19, wherein, with a profit value given on an axis, the output unit displays by means of a distribution diagram a probability distribution of each of profit values or a function approximating the probability distribution by means of a normal distribution or the like.

23. The system for processing business performance index using a computer according to claim 19, wherein the output unit displays required debt and equity values on a distribution diagram that represents, with a profit value given

FIG. 1

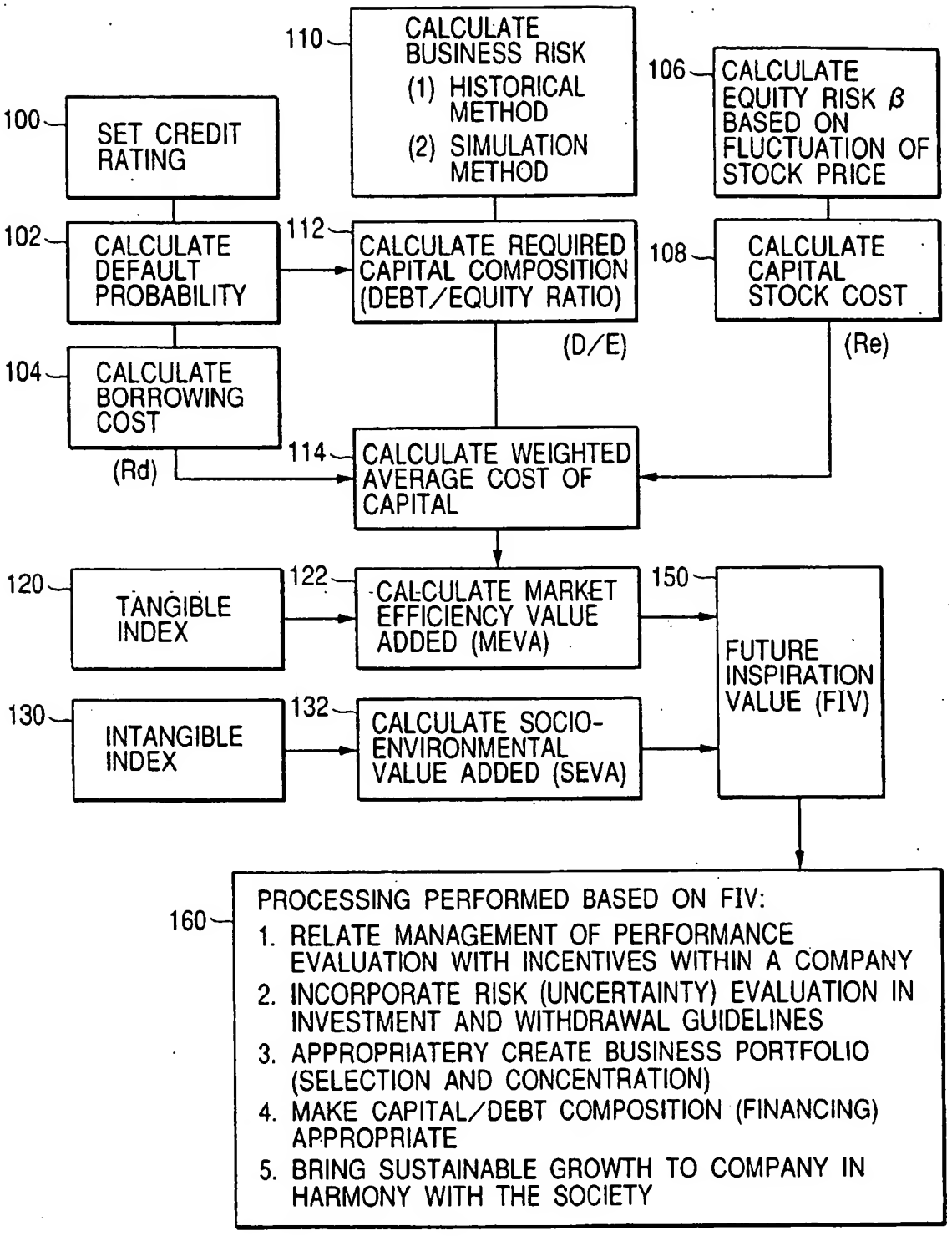
110
CALCULATE BUSINESS RISK
(1) HISTORICAL METHOD
(2) SIMULATION METHOD
106
CALCULATE EQUITY RISK β BASED ON FLUCTUATION OF STOCK PRICE
100
SET CREDIT RATING
102
CALCULATE DEFAULT PROBABILITY
112
CALCULATE REQUIRED CAPITAL COMPOSITION (DEBT/EQUITY RATIO)
108
CALCULATE CAPITAL STOCK COST
(D/E)
(Re)
104
CALCULATE BORROWING COST
(Rd)
114
CALCULATE WEIGHTED AVERAGE COST OF CAPITAL
120
TANGIBLE INDEX
122
CALCULATE MARKET EFFICIENCY VALUE ADDED (MEVA)
150
FUTURE INSPIRATION VALUE (FIV)
130
INTANGIBLE INDEX
132
CALCULATE SOCIO-ENVIRONMENTAL VALUE ADDED (SEVA)
160
PROCESSING PERFORMED BASED ON FIV:
1. RELATE MANAGEMENT OF PERFORMANCE EVALUATION WITH INCENTIVES WITHIN A COMPANY
2. INCORPORATE RISK (UNCERTAINTY) EVALUATION IN INVESTMENT AND WITHDRAWAL GUIDELINES
3. APPROPRIATERY CREATE BUSINESS PORTFOLIO (SELECTION AND CONCENTRATION)
4. MAKE CAPITAL/DEBT COMPOSITION (FINANCING) APPROPRIATE
5. BRING SUSTAINABLE GROWTH TO COMPANY IN HARMONY WITH THE SOCIETY

FIG. 4

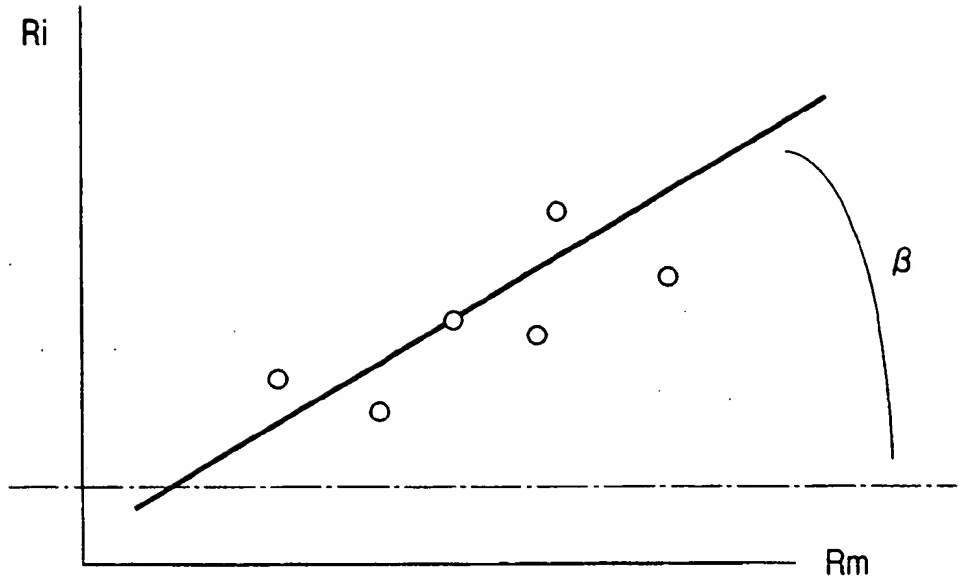

FIG. 5

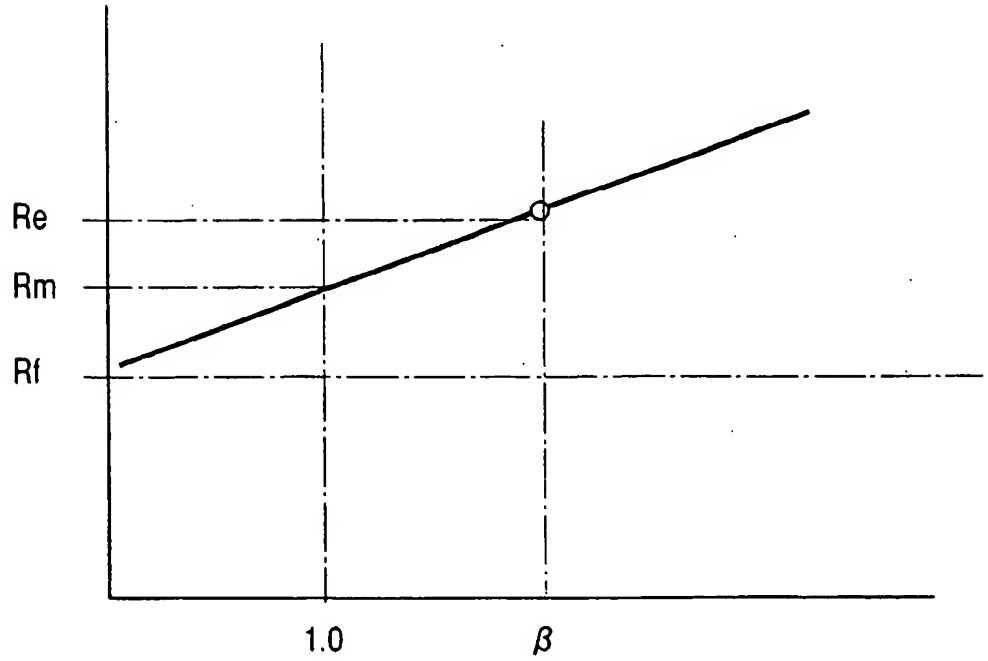

FIG. 8

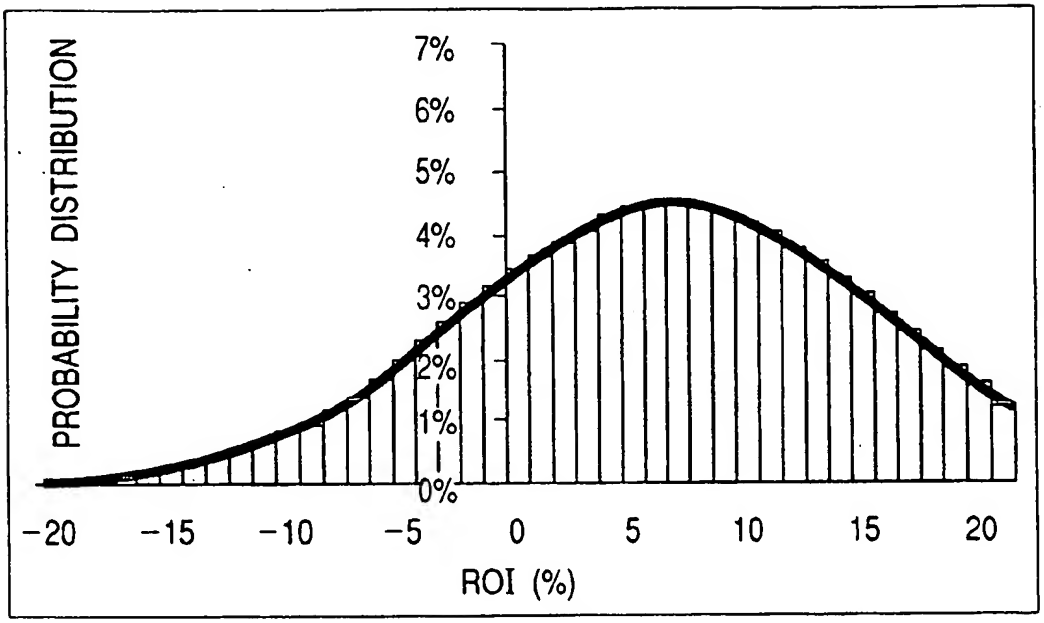
PROBABILITY DISTRIBUTION
7%
6%
5%
4%
3%
2%
1%
0%
-20
-15
-10
-5
0
5
10
15
20
ROI (%)

FIG. 9

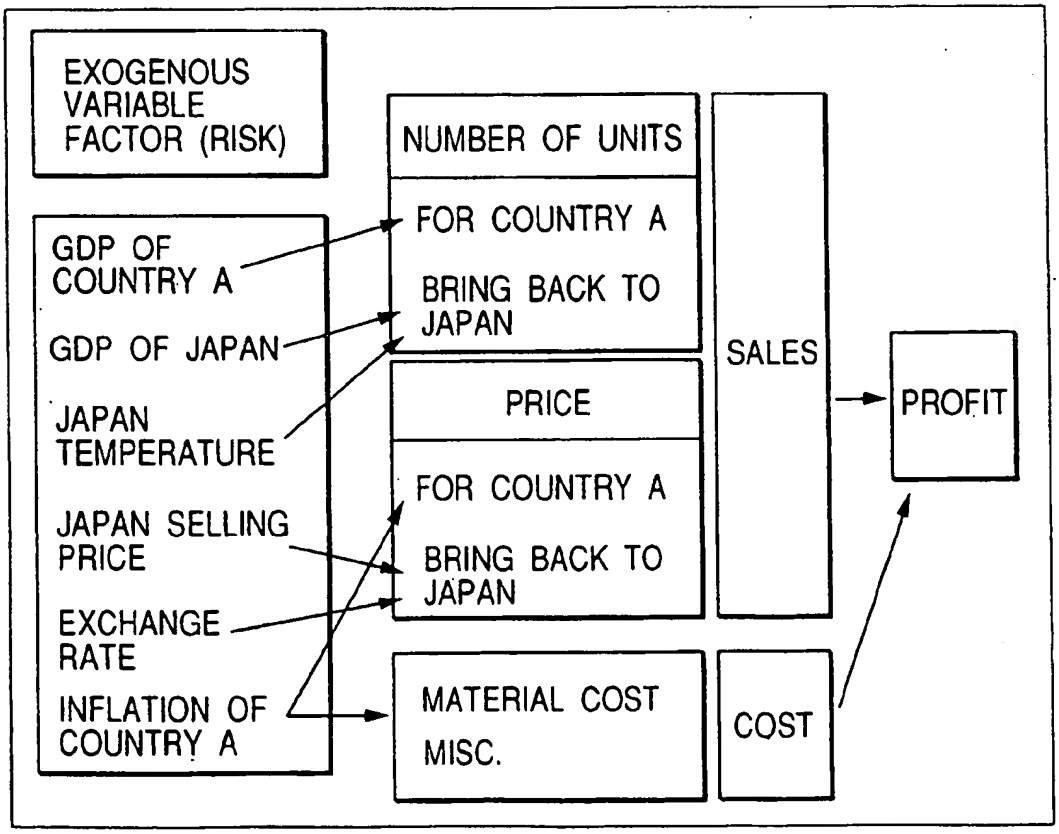
EXOGENOUS VARIABLE FACTOR (RISK)
GDP OF COUNTRY A
GDP OF JAPAN
JAPAN TEMPERATURE
JAPAN SELLING PRICE
EXCHANGE RATE
INFLATION OF COUNTRY A
NUMBER OF UNITS
FOR COUNTRY A
BRING BACK TO JAPAN
PRICE
FOR COUNTRY A
BRING BACK TO JAPAN
MATERIAL COST
MISC.
SALES
COST
PROFIT

FIG. 11

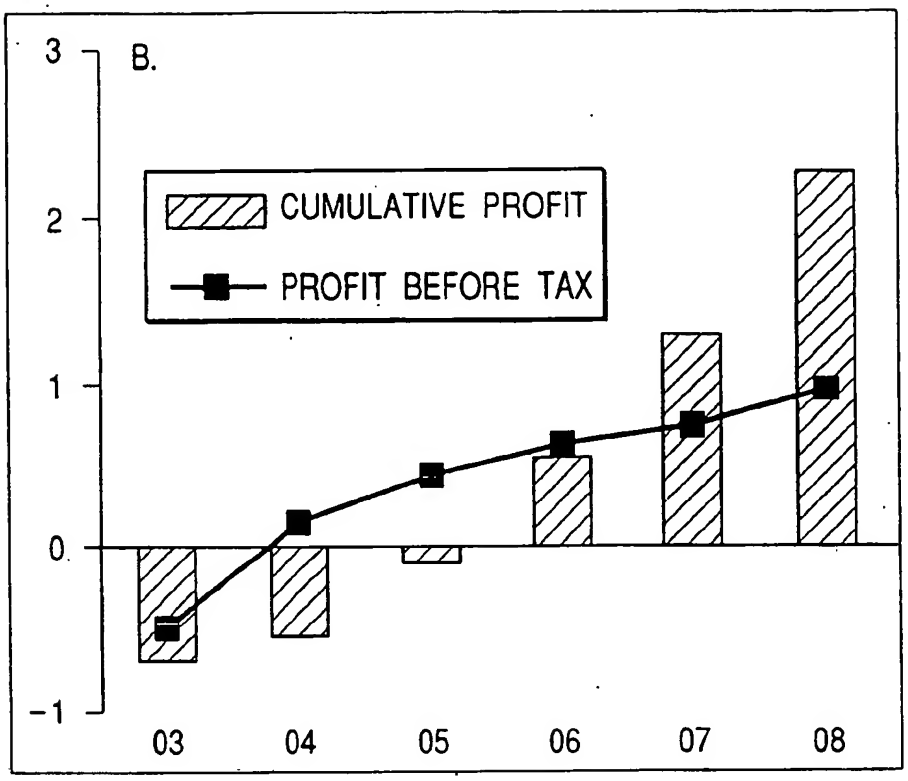
B.
CUMULATIVE PROFIT
PROFIT BEFORE TAX
3
2
1
0
−1
03
04
05
06
07
08

FIG. 12

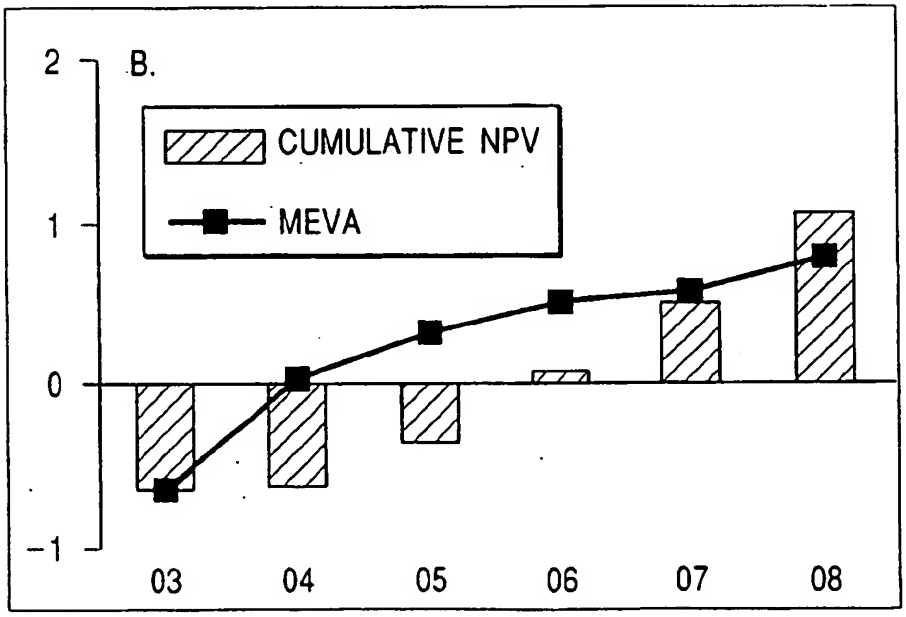
B.
CUMULATIVE NPV
MEVA
2
1
0
−1
03
04
05
06
07
08

FIG. 14

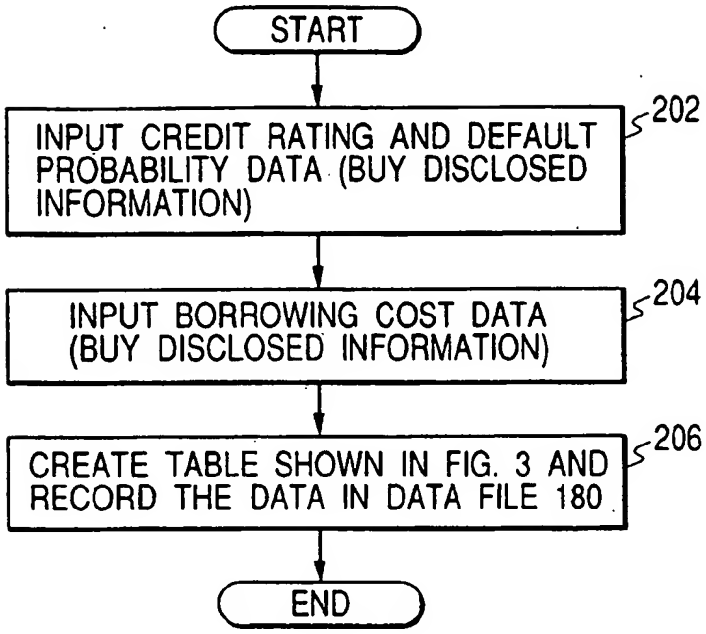

FIG. 15

(DETAILED FLOW OF FIG. 1)

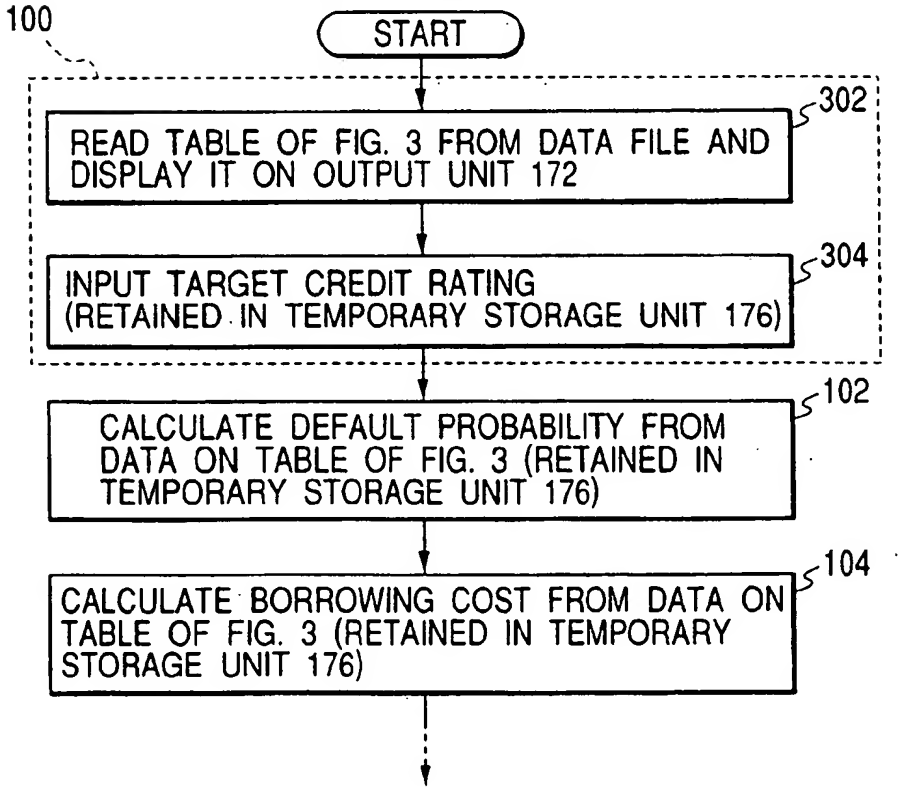

FIG. 17

(DETAILED PROCESSING FLOW OF FIG. 1)

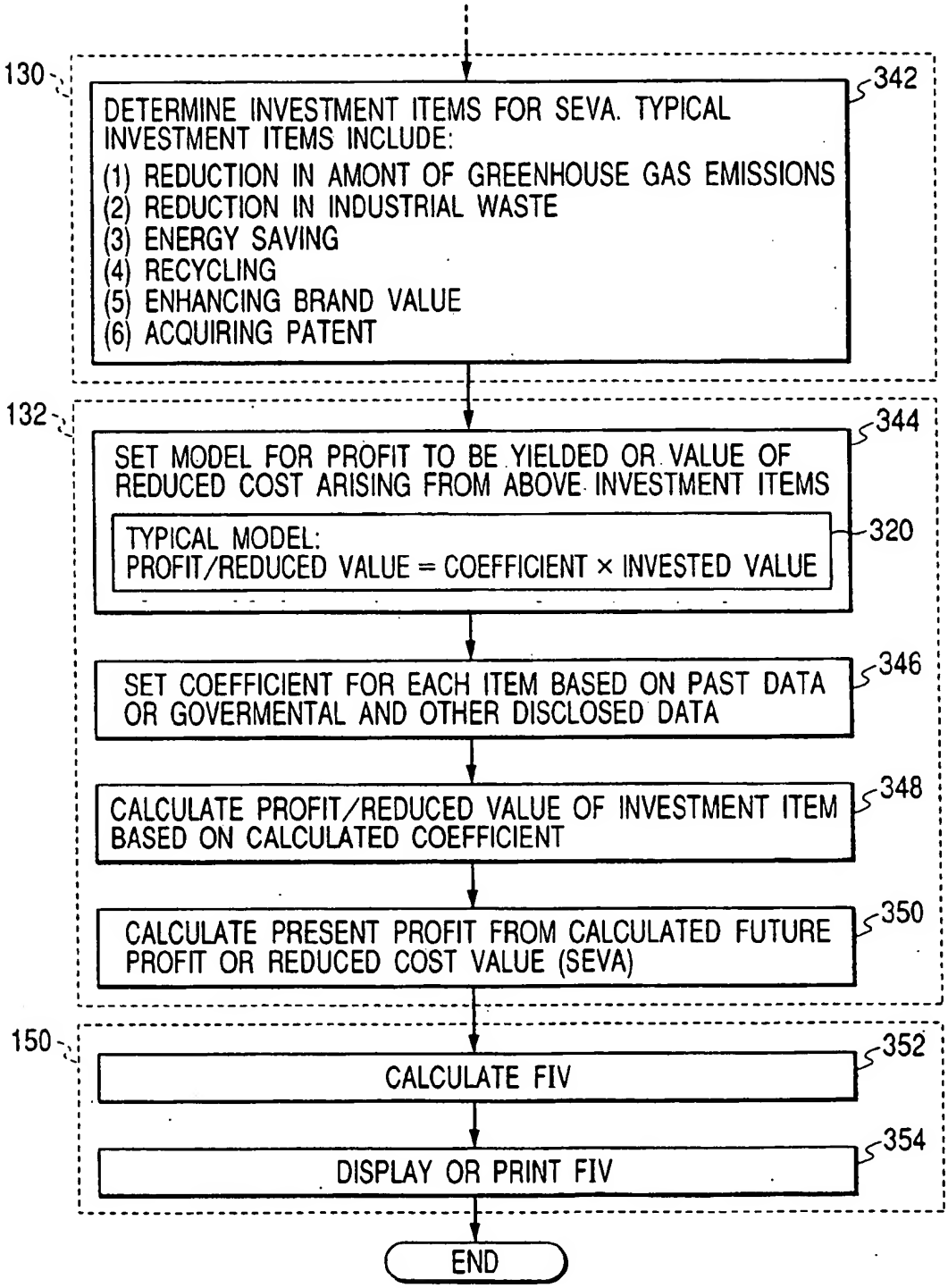

FIG. 19

(PROCESSING OF SIMULATION METHOD OF STEP 110)